In the Matter of

	)	
Amendment of the Commission's Rules Governing Hearing Aid-Compatible Mobile Handsets	)))	**WT Docket No. 07-250**
	)	
Section 68.4(a) of the Commission's Rules Governing Hearing Aid Compatible Telephones	))	**WT Docket No. 01-309**
	)	
Service Rules for the 698-746, 747-762 and 777-792 MHz Bands	))	**WT Docket No. 06-150**
	)	

REPORT and COMMENTS of AMERICAN NATIONAL STANDARDS INSTITUTE ACCREDITED STANDARDS COMMITTEE C63®

ANSI ASC C63® is pleased to present this report, providing additional information and further developments as a complement to our report of May 30, 2008. These reports are a product of ANSI ASC C63®'s continuing effort to address new and emerging wireless technologies for hearing aid compatibility (HAC). These efforts are in direct response to and support of FCC WTB / OET requests and Orders[1]

We anticipate providing multiple filings on this topic. This document presents the framework and approach being used as ANSI ASC C63® pursues simultaneously ongoing development and refinement of ANSI C63.19, *American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids*, and how most appropriately to address concerns for hearing aid compatibility for new and future wireless technologies. This framework is then utilized to define the process that will be used in addressing those questions. Future filings will present data and report progress on the work of ANSI ASC C63® on this topic. The first of those filings, reporting some recent research data is

1 FCC Report and Order 08-68, released February 28, 2008; WT Docket 07-250; ¶¶ 58-68; FCC Report and Order

in draft and is anticipated in the very near future. FCC WTB/OET has requested information to assist them in their review of the HAC impact of some specific technologies and this data will provide insight to the HAC issue for those specific technologies.

These comments begin with a description of the scientific facts that must guide the technological resolution of these issues. The responsibility of ANSI ASC C63® is first and foremost to be scientifically based and consensus driven in all its processes. Accordingly, the science must define the process. From the science naturally arises a fact based process for resolving these questions. At the end of these comments a review of that process to assess new technology for HAC interference potential is described. It contains flow diagrams that show how C63® is approaching these evaluations. Estimates of the time and resources it will take to make these assessments and reach conclusions are discussed.

I. Technology evaluation is different than product evaluation

It has become apparent that the evaluation of technology is different from the testing of individual products for HAC. ANSI ASC C63® has separated those two types of evaluations and is treating them as two steps in a larger process. This is important because a technology can be evaluated separately from devices that implement it. This means that a new technology's potential to cause interference can be evaluated before any products implementing that technology are available. This fact is very significant as it allows the possibility of providing developers of new technology some certainty on how this issue will affect their products.

When ANSI ASC C63® first took up the HAC issue in 1996 the fact that the then new digital mobile phone technologies (e.g., 2G, 3G) caused hearing aid interference was readily apparent and easily demonstrated. What was needed was a standard to evaluate the degree to

07-72, released April 27, 2007;WT Docket 01-309; ¶¶ 137-150 which a specific product would exhibit hearing aid interference. The ANSI C63.19 standard was written to address this need for product evaluation. The standard is the result of significant deliberations and research from a WG within ASC C63® which over the course of the project had over 100 WG members, representing all interested parties. This resulted in the first edition of ANSI C63.19 in 2001.

With new wireless technologies the potential for causing hearing aid interference is not known and must be established. Historically, it is helpful to remember that the first mobile phone technologies did not cause hearing aid interference. The FCC took no action regarding mobile phone hearing aid interference with first generation analog phones. There simply was not a problem. Interference became an issue with the introduction of second generation digital wireless technologies. Even then not all technologies have the same potential for hearing aid interference.[2] Thus, a significant precedent was set regarding a differentiation between technological potential for interference and a requirement to test every product. In the first version of the standard 1st generation analog technology products were included, with the requirement that those products be tested. Later the Commission exempted analog mobile phones from testing and in agreement with that decision, ANSI ASC C63® removed the requirement to test analog phones from the next edition of the standard. Thus a second precedent was set that if it can be demonstrated that a technology has little potential for hearing aid interference a decision to not require testing of products that use the technology can be made responsibly.

As introduced earlier, the evaluation of a technology is different and separate from evaluation of individual products. Logically, if a technology is found to have a diminishing potential for interference requiring testing of individual products serves little useful purpose.

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2 For example, in the current ANSI C63.19 standard, GSM is weighted by an additional 5 dB as compared to CDMA or UMTS. This is because it was scientifically verifiable that the GSM waveform had a higher potential for interference by that amount

Alternately, if a technology does have a significant potential for interference then testing of individual products to determine the degree to which they manifest that potential for interference becomes necessary.

II. The physics of interference

Since the work of ANSI ASC C63® on hearing aid compatibility started in 1996 much has been learned. The fundamental physics of this phenomenon has been carefully studied and is now understood as it has been proven through research and experience with fielded products. This physical model of interference is presented in ANSI C63.19-2007 (both the 2006 and 2007 editions were successfully balloted and approved by all stakeholders and have subsequently been reviewed and adopted by the Commission). It is this well developed and tested insight into the underlying physics that offers significant hope for reliable evaluation of the potential of technologies to cause hearing aid interference.

From ANSI C63.19-2007 the following passage provides the physical model of the interference mechanism:

> The following discussion is given to clearly and succinctly describe the physical quantity to be measured.[3] This quantity, which shall be called "RF interference level," is defined by the following characteristics. Conceptually, this definition is intended to correlate to the user perception of interference received through an idealized hearing aid and is characterized by the following attributes (depicted in Figure 4.1):
>
> — The full signal bandwidth shall be presented to a wideband detector, meaning that the sensing elements and the detector shall have a bandwidth greater than or equal to the emission bandwidth.
>
> — The RF signal shall be detected by a square law detector.[4]
>
> — The post-detection, recovered audio signal shall be limited to greater than or equal to the audio band.[5]

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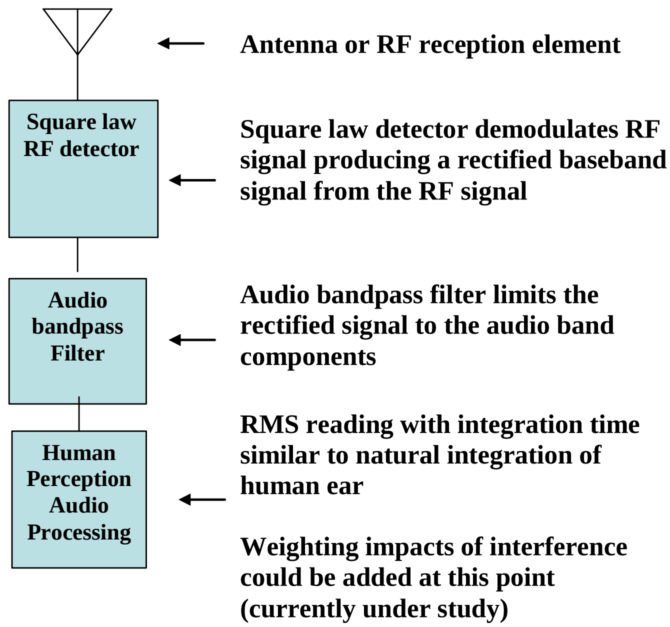
3 In some cases the instrumentation used to measure this quantity can perform a direct measurement. In other cases, a compensation, known as a probe modulation factor, must be utilized, to accurately measure the required RF value.

4 After the square law detector, the signal is the recovered audio interference that would be received by a hearing aid.

5 The signal that is available after the square law detector is the post-detection signal. It contains the demodulated AM envelope and therefore the recovered audio signal. However, it also contains components that are outside the audio band and therefore, this step calls for the signal to be band limited to the audio band.

— The typical response of human hearing is applied to the detected signal before determining the final category.[6]

The test procedure specified in this revision does not yet address all elements of the preceding conceptual model.[7]



ANSI C63.19-2007 Figure 4.1—Conceptual model of RF interference level

What this explanation makes clear is that the potential for interference is completely dependent on the amount of energy a technology can deliver into the audio band. A

There is general agreement that for hearing aid users the upper boundary of the audio band is no higher than the 20 kHz specified in the definition of the audio band. A final determination on the lower boundary band and the frequency weighting within the audio frequency band has not been made. A-weighting has been shown to be a good predictor of human perception for steady-state interference but is not necessarily valid for interference that has substantial variation over time.

6 The Committee is continuing to study a generalized method for characterizing the human perception of interference signals. Human hearing is characterized by several characteristics of the signal, including its spectral and temporal features. A typical characterization might be an rms reading of the audio signal over a period of 120 msec ± 30 msec and taking the highest value during any 2 second period to arrive at a final reading in determining the category. The value of 120 msec is selected because it is consistent with the natural integration time of the human ear. The 2 second interval is selected to be consistent with the “click” relaxation in ANSI C63.4-2003, CISPR 14, and CISPR 16. Generally, variations in volume that occur less frequently than 2 seconds do not disrupt word recognition. However, a final determination of these values has not been made in this revision.

7 Clause 4 of ANSI C63.19-2007, *American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids*

second factor is the way that audio band energy is distributed, which determines the degree to which it is subjectively interfering and objectively impacts the ability to understand speech. The amount of energy delivered in turn is dependent on both the power of the transmitter and the characteristics of its waveform. If the transmitter is very low power it will have little potential for interference. Equally if the waveform used demodulates little energy into the audio band then even higher power transmitters will have little potential for interference.

When evaluating a new technology these factors can be quantified, evaluated and a determination made as to the potential for interference of the technology. The current work of the C63.19 WG within ANSI ASC C63® is treating this issue on a technical level, seeking to determine the correct and most efficient way to analyze new technologies for their potential for interference.

III. Analysis of the potential for interference

On July 29, 2008, the IEEE published IEEE Standard 1900.2, *IEEE Recommended Practice for the Analysis of In-Band and Adjacent Band Interference and Coexistence between Radio Systems*.[8] This new standard provides the best available technical consensus on how to construct an interference analysis. The process of IEEE 1900.2 coupled with the physical model of ANSI C63.19 produces a solid, science-based approach for the treatment of this problem.

Figure 8 of IEEE 1900.2, reproduced below, makes clear that there is a continuum of evidence that can be developed to gain understanding of an interference problem. Few problems justify treatment on all levels. If there is agreement that there is not an analytical probability of interference then there is little reason to require experimental measurements, looking for something that does not exist. Conversely, if there is either uncertainty or a clear

8 IEEE Standard 1900.2-2008, IEEE Recommended Practice for the Analysis of In-Band and Adjacent Band Interference and Coexistence Between Radio Systems.

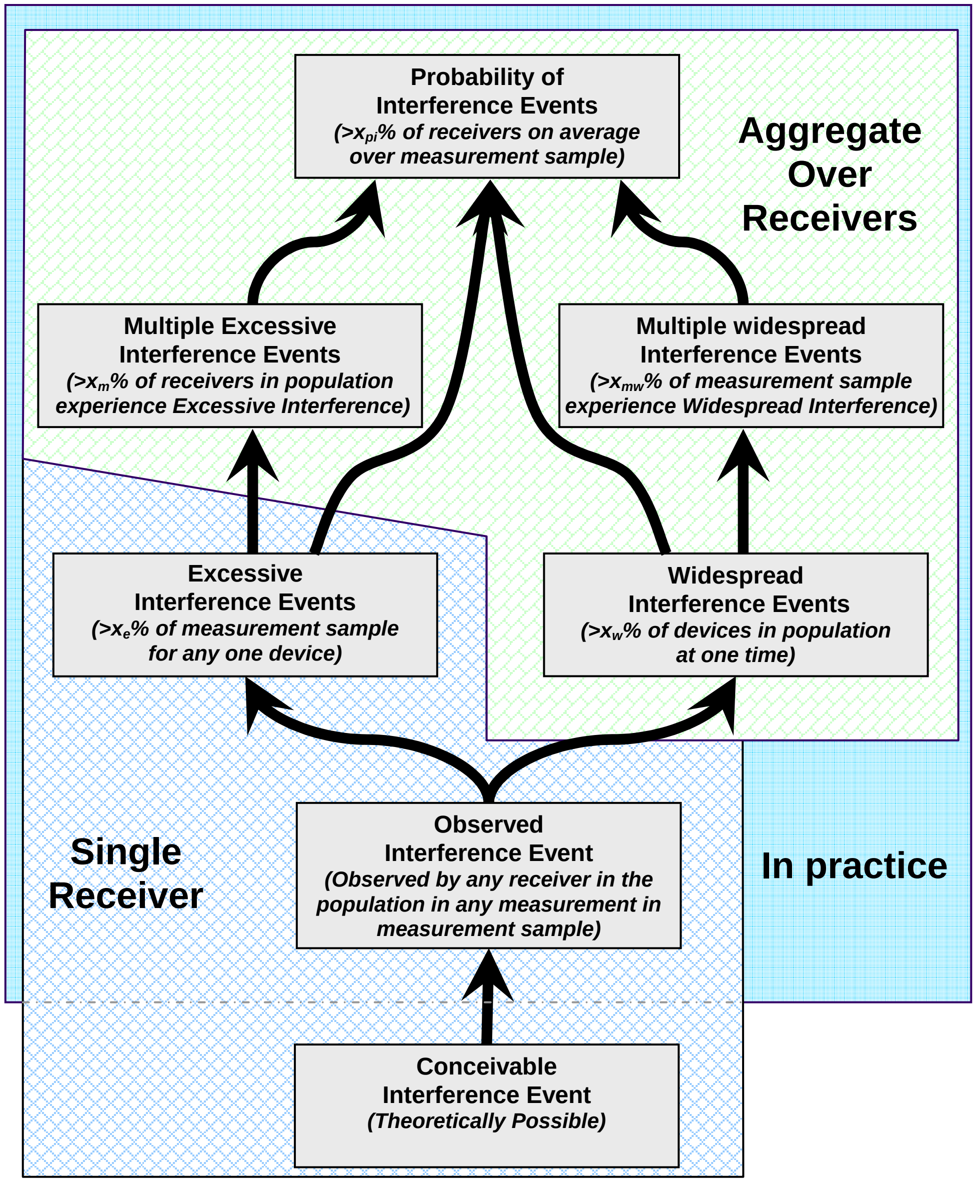
analytical possibility of interference then laboratory measurements are in order. If laboratory measurements prove the potential for interference exists then other levels of data become important. Questions that should be answered include:

> How frequently will that potential for interference manifest itself?
>
> What percentage of the population of potential victims of interference will in fact suffer interference?

It is this hierarchy of evidence that IEEE 1900.2 helps to clarify. This is very useful because it allows for an efficient decision making process but one in which scientific fact and objective data govern the outcome. At the bottom of the figure, and further described in IEEE 1900.2, is theoretical or analytical evaluation. If all agree with the analytical evaluation then there is no need for further treatment, and a decision can be made as to whether the potential for interference rises to the level that product testing is required. However, if there is debate or uncertainty about the analytical evaluation then laboratory data is needed to help clarify the potential for interference. In this case, two questions must be addressed and data developed to provide insight:

> How often an individual user experience interferences? or
>
> How many users will experience interference?

These two questions create two independent lines of evidence. Further detail and discussion is provided in IEEE 1900.2



IEEE 1900.2 Figure 8 – Harmful interference categories

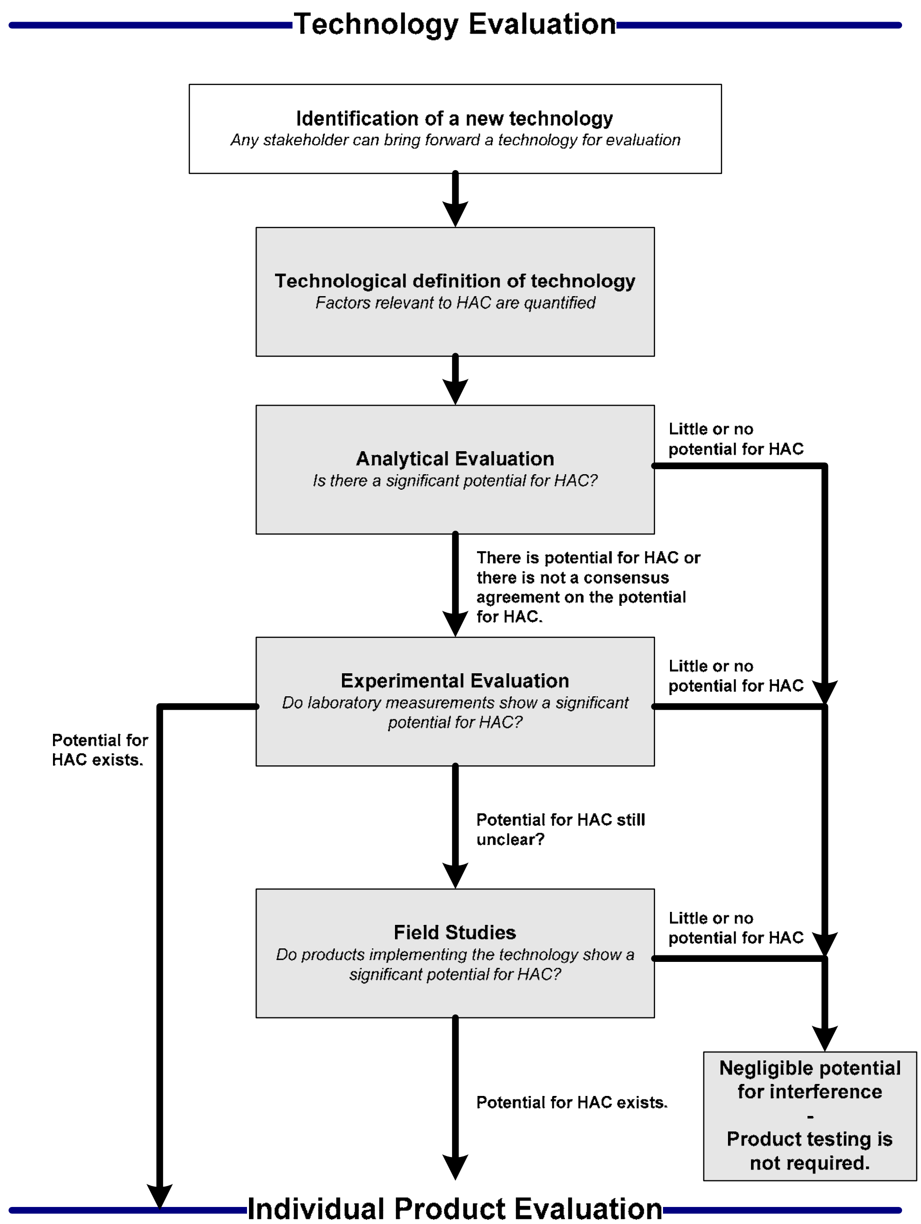
This figure has an overlay where there is a single receiver which also might be what is found in practice for particular situations. Hence the "In practice" part applies to both the base and the overlay situations.

The value of IEEE 1900.2 is that it makes clear that there is a progression of evidence. It requires a structure that forces the clarification of assumptions and allows analytical analysis, laboratory measurements and field data to be brought to bear on a problem, each playing its own role.

For the question being addressed in these comments, the combination of the physics model of ANSI C63.19 and the interference analysis structure of IEEE 1900.2 allows for a solidly science based approach to guide the Commission.

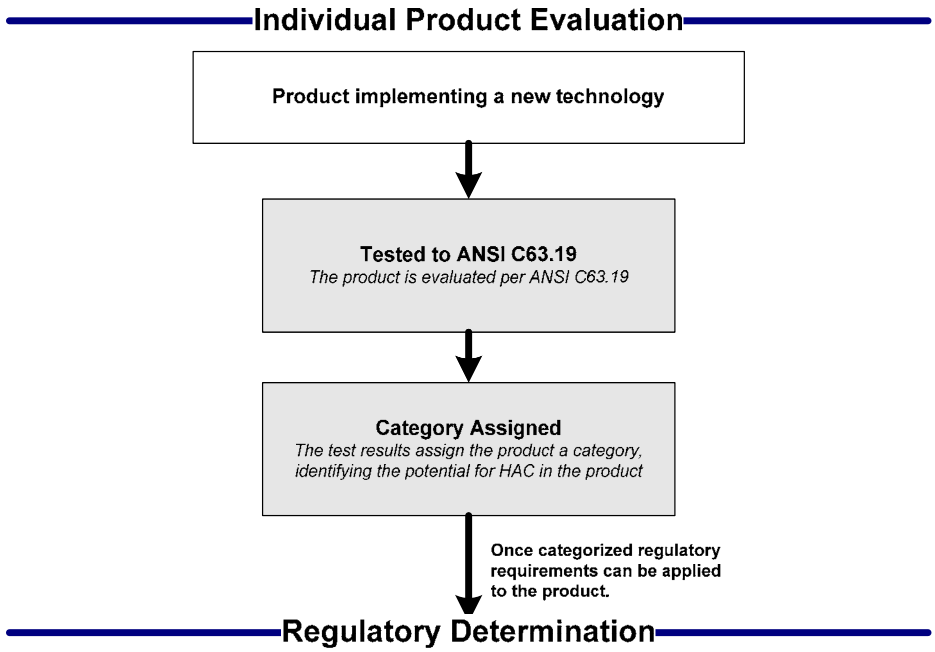
IV. Application of the model to HAC

Flow Chart No. 1 below illustrates the interference analysis model of IEEE 1900.2 applied to the evaluation of a new technology for its potential to produce interference or HAC. The conclusion of the evaluation may be that product testing is either required or not required.



Flow Chart No. 1 -- Evaluation of a new technologies potential for HAC

If a technology exhibits sufficient potential for HAC then testing of individual products becomes necessary. Flow Chart No. 2 illustrates the treatment of individual products by ANSI C63.19. The working group for ANSI C63.19 is actively working to revise this standard so that it appropriately addresses new technologies.

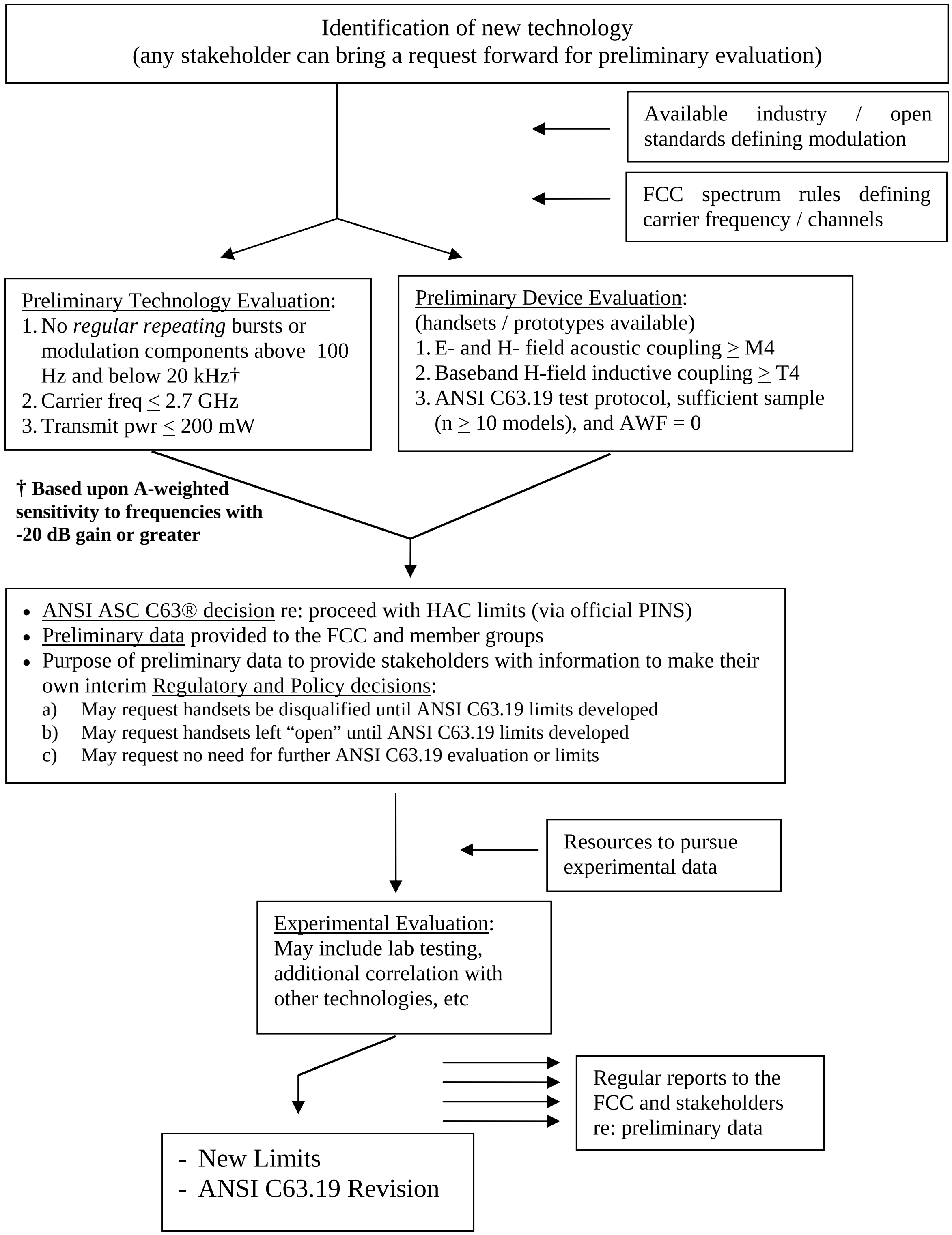


Flow Chart No. 2 – Product testing for HAC is necessary to determine compliance with regulatory requirements

ANSI ASC C63® intends to continue its work on technology evaluation in parallel with its continued work revising the ANSI C63.19 standard. We will continue to communicate our progress to the Commission.

V. Discussions with stakeholders

ANSI ASC C63® has been and is continuing to discuss these issues with stakeholders and is pursuing the exchange of information and forging of a creation viewpoint. In those discussions Flow Chart No. 3 has been presented and discussed in some detail.


Identification of new technology
(any stakeholder can bring a request forward for preliminary evaluation)
Available industry / open standards defining modulation
FCC spectrum rules defining carrier frequency / channels
Preliminary Technology Evaluation:
1. No *regular repeating* bursts or modulation components above 100 Hz and below 20 kHz†
2. Carrier freq $\leq$ 2.7 GHz
3. Transmit pwr $\leq$ 200 mW
Preliminary Device Evaluation:
(handsets / prototypes available)
1. E- and H- field acoustic coupling $\geq$ M4
2. Baseband H-field inductive coupling $\geq$ T4
3. ANSI C63.19 test protocol, sufficient sample (n $\geq$ 10 models), and AWF = 0
† Based upon A-weighted sensitivity to frequencies with -20 dB gain or greater
• ANSI ASC C63® decision re: proceed with HAC limits (via official PINS)
• Preliminary data provided to the FCC and member groups
• Purpose of preliminary data to provide stakeholders with information to make their own interim Regulatory and Policy decisions:
a) May request handsets be disqualified until ANSI C63.19 limits developed
b) May request handsets left "open" until ANSI C63.19 limits developed
c) May request no need for further ANSI C63.19 evaluation or limits
Resources to pursue experimental data
Experimental Evaluation:
May include lab testing, additional correlation with other technologies, etc
Regular reports to the FCC and stakeholders re: preliminary data
- New Limits
- ANSI C63.19 Revision

Flow Chart No. 3 – Flowchart used in discussions with stakeholders

This flowchart is important in that it represents discussions with member representatives from the hearing loss community, hearing aid industry, wireless industry, and other key SC8 WG3 members. It was from those discussions that the difference between evaluating a wireless technology and evaluating individual products became clear. Although the current flowchart includes some initial device evaluation, the goal is to develop an analytical model that will eventually replace empirical evaluation altogether.

VI. Preliminary data

In parallel with these discussions, research is being performed and data gathered. ANSI ASC C63® is happy to accommodate stakeholders with preliminary data as long as an understanding exists that, while being an indicator, preliminary data is not an absolute guarantee of future limits nor would it constrain ASC C63® regarding further signal evaluation or subsequent standard revisions. The flow charts presented with these comments outline an empirical process that ANSI ASC C63® will employ to evaluate new and emerging wireless technologies for HAC. In parallel, ANSI ASC C63® is developing an expanded analytical / predictive model with the goal of bring further refinement and improvements to the process. This of course will be validated possibly by some testing or agreement with stakeholders of its efficacy. ANSI ASC C63® intends to share all relevant preliminary data on a regular basis at ANSI ASC C63® meetings, Subcommittee 8 and Working Group 3 conference calls and meetings, and in reports to the FCC (OET, WTB) as we are doing in this filing. In addition, ANSI ASC C63® will use preliminary data to help guide decisions on whether further development of limits and test procedures for a given signal technology is warranted.

VII. Timeline

ANSI ASC C63® intends to provide meaningful preliminary data for new and emerging technologies brought forward for evaluation by any of its member participants (including the FCC) within three months of any evaluation request (See flow chart No. 3). In this three month period, ANSI ASC C63®, Subcommittee 8, Working Group 3 will decide whether more detailed evaluation and HAC limits via an official PINS[9] is warranted. This timeline is dependent upon having sufficient information and laboratory support for technology evaluation. If product testing becomes necessary, then sufficient handsets must be available for testing as well as cooperation from handset manufacturers and other stakeholder groups. If further experimental evaluation is deemed necessary, an attempt will be made to gather conclusive information and define limits or exclusions within 12 months as a target. Finally, our best-estimate of the standard revision, balloting, and publication process is an additional 12 months realizing that there was only one year between the 2006 and 2007 editions of C63.19. The point is that with full support and resources, the timeline can be minimized.

To summarize, ANSI ASC C63® is committed to making every effort to adhere to these timelines, although as indicated this will depend on several factors, including stakeholder participation. The timeline and milestones may be revised if consensus agreement is obtained among ASC C63 SC8 WG3 members.

VIII. Conclusions

9 Project Initiation Notification System - used by ANSI to officially record projects that are performed by accredited

ANSI ASC C63® is continuing its work to both improve and refine ANSI C63.19 and address the need to evaluate new wireless technologies as to their potential to cause hearing aid interference. We are currently preparing an additional filing to the Commission to present recent research data on this topic. As the work on the standard and new data becomes available we will continue to communicate those developments to the Commission.

Respectfully submitted,

ANSI ASC C63®

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standards committees such as ASC C63®. ASC C63® first approves the PINS for any work on new or existing ASC C63® standards such as C63.19.